Investigation into the Effect of Roughness on the Unbinding Transition

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There has been considerable interest over recent years in the effects of different types of disorder on the nature and universality of wetting transitions motivated by the presence of impurities in actual experiments. One of the most frequently studied systems is that in which geometrical disorder is present in the form of substrate roughness. In 2D there is compelling evidence that the critical wetting transition found for a flat substrate may become first order when surface roughness is included via the presence of a self affine wall. In particular if the roughness exponent of the wall exceeds the anisotropy index of interface fluctuations in the bulk then first order wetting is found.

Here we present recent results extending the investigation of roughness induced effects both to higher dimensions and to more general classes of unbinding transition. Thus, for example, we consider the unbinding of two fluctuating interfaces characterized by different roughness exponents $\zeta 1$ and $\zeta 2$ say (e.g. a fluid membrane depinning from a liquid-vapour interface as may arise in the preparation of membranes for biological applications). In this case symmetry prevents a change in order of the unbinding transition as the rougnesses are varied, however the critical behavior is again found to be sensitive to the sign of $\zeta 1 - \zeta 2$. In addition our results depend quantitatively on a non-universal parameter related to the relative curvature of the two interfaces whenever $\zeta 1 \neq \zeta 2$.